

Claims

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1. Titanium or a titanium alloy which is surface-treated by an imidazole compound.

2. The titanium or titanium alloy according to claim 1, wherein the imidazole compound is an imidazole silane compound.

3. An adhesive resin composition for titanium or a titanium alloy, comprising: a thermosetting resin and an imidazole compound.

4. The adhesive resin composition for titanium or a titanium alloy according to claim 3, further comprising a thermoplastic resin.

5. The adhesive resin composition for titanium or a titanium alloy according to any of claims 3 and 4, wherein the imidazole compound is an imidazole silane compound.

6. An adhesive resin composition for titanium or a titanium alloy, comprising: a thermosetting resin and a thermoplastic resin.

7. The adhesive resin composition for titanium or a titanium alloy according to any of claims 4 to 6, wherein the thermoplastic resin has a fracture energy release rate G_{1c} of 4500 J/m^2 or more.

8. The adhesive resin composition for titanium or a titanium alloy according to any of claims 4 to 7, wherein the thermoplastic resin in the adhesive resin composition that has been cured is in a discontinuous phase as well as in a cohesive phase.

9. The adhesive resin composition for titanium or a titanium alloy according to any of claims 4 to 8, wherein the thermoplastic resin in the adhesive resin composition is a crystalline thermoplastic resin.

10. The adhesive resin composition for titanium or a titanium alloy according to any of claims 3 to 9, wherein the thermoplastic resin is an epoxy resin.

11. An adhesive resin film for titanium or a titanium alloy

comprising the adhesive resin composition according to any of claims 3 to 10.

12. A prepreg comprising the adhesive resin composition according to any of claims 3 to 10 and reinforcing fibers.

13. The prepreg according to claim 12, wherein the reinforcing fibers are impregnated with the adhesive resin composition.

14. The prepreg according to claim 12, wherein the adhesive resin composition is placed on a surface layer of the prepreg.

15. A prepreg comprising the adhesive resin film according to claim 11 placed on the surface layer of the prepreg.

16. The prepreg according to any of claims 12 to 15, wherein the reinforcing fibers are carbon fibers.

17. A composite material comprising: the titanium or titanium alloy according to claim 1 or claim 2 and an adhere that are adhered to each other.

18. The composite material according to claim 17, wherein the adhere is a plastic material or a metal material.

19. The composite material according to claim 18, wherein the adhere is a fiber reinforced plastic material.

20. The composite material according to claim 19, wherein a discrete adhesive resin layer is formed between the titanium or a titanium alloy and the fiber reinforced plastic.

21. A composite material wherein titanium or a titanium alloy and an adhere are adhered to each other through an adhesive resin layer formed by curing the adhesive resin composition according to any of claims 3 to 10.

22. A composite material wherein titanium or a titanium alloy and an adhere are adhered to each other through an adhesive resin layer formed by curing the adhesive resin film according to claim 11.

23. The composite material according to claim 21 or claim 22, wherein the adhere is a plastic material or a metal material.

24. The composite material according to claim 23, wherein

the adhere is a fiber-reinforced plastic.

25. A composite material wherein titanium or a titanium alloy and the prepreg according to any of claims 12 to 16 are adhered to each other.

26. The composite material according to any of claims 17 to 25, wherein the peel torque of the titanium or titanium alloy from the adhere, measured in compliance with ASTM D 1781-98, is 5N-mm/mm or more.

27. A surface treatment method of titanium or a titanium alloy comprising the step of: surface-treating the surface of the titanium or titanium alloy by using an imidazole compound or a solution thereof.

28. A manufacturing method of a composite material comprising the step of: applying the adhesive resin composition according to any of claims 3 to 10 to the surface of titanium or a titanium alloy.

29. A manufacturing method of a composite material comprising the step of: laminating the adhesive resin film according to claim 11 to the surface of titanium or a titanium alloy.

30. A manufacturing method of a composite material comprising the step of: laminating the prepreg according to any of claims 12 to 16 to the surface of titanium or titanium alloy.

31. A manufacturing method of a composite material comprising the steps of: applying an adhesive resin composition containing a thermosetting resin and a thermoplastic resin to the surface of titanium or a titanium alloy; and conducting a heating process to a temperature of not less than the melting point of the thermoplastic resin.